

## **REMARKS**

Claims 1-18, 20, 22 and 25 are pending in the application.

Claims 1 and 22 are amended above to overcome the examiner's Section 101 and Section 112 rejections.

Claim 25 is amended above to convert it into an independent claim.

The specification is amended above to include the original claim term "specified extent".

No new matter has been added to the application by way of these specification and claim amendments.

### **I. THE CLAIM 25 OBJECTION**

The examiner objected to claim 25 because it was not apparent whether it was an independent or a dependent claim.

This objection is overcome by amending claim 25 to convert it into an independent claim.

### **II. THE SECTION 101 REJECTION OF CLAIM 1-18, 20 AND 22**

The examiner rejected claims 1-18, 20 and 22 for failing to fall within a statutory class of invention.

The examiner's rejection is overcome by amending claims 1 and 22 to require the claimed steps to be performed by a computer or processor.

### **III. THE SECTION 112 FIRST AND SECOND PARAGRAPH REJECTIONS**

The examiner rejected claims 1-18, 20, 22 and 25 under both the first and second paragraphs of Section 112. In particular, the examiner takes the position that the term "defining respective regions of specified extent within the image around said locations . . ." of independent claims 1 and 22 is not disclosed by the original specification as required by the first paragraph of Section 112. Moreover, the examiner rejects the same claims under the second paragraph of Section 112 because it is not clear what the term "which" in step (a) of claims 1 and 22 refers to.

The examiner's claim rejection under the first paragraph of 35 USC 112 is traversed. The term "defining respective regions of specified extent within the image around respective said locations" recited in claims 1 and 22 is clearly disclosed in the originally filed specification at least at page 10, line 25 - page 11, line 2 where the specification discloses that local regions of

interest (ROIs) are defined around the locations of each of the objects which remain after the previous processing stage. The cited excerpt reads in part:

For each of the objects remaining after stage 22, a local region of interest (ROI) is selected. This ROI is centred on the nominal centre of the object (as found in stage 21), and has an extent of 50 pixels in each direction, the region size being truncated as necessary to ensure the ROI lies within the bounds of the original image. This allows ROIs which would otherwise overlap the edges of the image to be included. Alternatively the ROIs could be defined by taking the regions identified in stage 22 and adding a border of a selected number of pixels. In either case, it is desirable that the ROIs exceed the size of those regions somewhat in order to ensure the generation of the low-resolution contours.

(Emphasis added). In the excerpt, the regions of interest or ROIs are alternatively referred to as regions. In one of the examples discussed in the excerpt above, the ROI or region has an extent of 50 pixels in each direction. This is a “specified extent” of the region. In the alternative example, the identified regions are given “a border of a selected number of pixels” – in other words, a specified extent. Examples of such regions of interest with specified extent are also indicated at 30 and 40 in Figures 3 and 4 which are described on page 13, line 25 – page 14, line 17 of the specification. Thus the specification and in particular the portions of the specification recited above disclose ROI’s having regions of specified extent.

In order to provide an express basis in the specification for the term as it is used in the claims, the Applicant has amended the paragraph above to identify the “extent” of the pixels as a “specified extent” and to identify the step of defining the ROI as giving the region a “specified extent”. Support for this amendment is found in the specification and in the claims as originally filed with the application.

With regard to the 35 USC 112 second paragraph rejection, it is the objects rather than their locations which have the specified intensity and size characteristics. Claims 1 and 22 have been amended above to clarify this aspect of the claimed invention. The section of the specification headed “Location of candidate cell nuclei” from page 5, line 25 to page 9, line 16 describes how an embodiment of claim step (a) is performed and provides support for this claim amendment.

Finally, it is unclear from the Office Action whether the examiner has raised one or more than one rejection under the second paragraph of Section 112. The Applicant believes that the entire Section 112 second paragraph rejection is a single rejection premised upon the examiner’s

inability to understand just what feature the claim term the term “which” referred to. The Applicant has fully responded to the Section 112, second paragraph rejection above based upon its assumption.

#### **IV. THE OBVIOUSNESS REJECTIONS**

Claims 1-14, 17-18, 20, 22 and 25 stand rejected for being obvious over the Netsch Article (“Netsch”) in view of the Madachy Article (“Madachy”). Claim 15 stands rejected for being obvious over Netsch in view of Soni et al. (USP 5,363,850). Claim 16 stands rejected for being obvious over Netsch in view of DeLong (USPA 2002/0012466). All pending claims are non-obvious and patentable because the cited prior art does not disclose every claim feature. In particular, the cited prior art does not disclose steps (b) or (c) or (d) of each of the independent claims.

As is apparent from the Abstract on page 774 of Netsch and the METHOD section on page 776, Netsch’s aim is the detection of microcalcifications in digitized mammograms and this is achieved by a method comprising the steps of (1) finding bright, almost circular spots in the mammogram; (2) estimating the size  $D$  and local contrast  $C$  of each spot; and (3) marking (that is to say labelling or classifying) a spot as a microcalcification if  $C > C_t(D)$  where  $C_t$  is a given threshold depending on the estimated size  $D$  of the spot. The location process is performed by the application of a two dimensional Laplacian filter which does have some similarity to the applicant’s process in its “Location of candidate cell nuclei” section and to claim step (a). This is, however, where the similarity of Netsch’s method to Applicant’s claim 1 ends.

Independent claim 1 is non-obvious and patentable at least because the cited prior art does not disclose or suggest the claim steps of: (b) defining respective regions of specified extent within the image around respective locations identified in step (a); or (c) deriving from the data within respective said regions one or more respective closed contours comprising points of equal intensities. With regard to independent claim 1 step (b), the examiner appears to believe that “mark a spot” in step (3) of Netsch on page 776 somehow refers to defining a region within the image around the location of a spot (i.e. object) which has been found in Netsch’s step (1). However the cited Netsch excerpt teaches nothing of the sort. What the cited Netsch excerpt teaches is that the spot is labelled or classified as being a microcalcification if it satisfies the

$C > C_r(D)$  criterion specified in step (3) of the reference. Moreover, Madachy does not supply this missing Netsch teaching.

Independent claim 1 is further non-obvious and patentable because the cited prior art does not disclose step (c) of claim 1. The Examiner appears to believe that Netsch's Figure 3, equations (1)-(4) and references to "circularly-symmetric Gaussian function" and "Gaussian function is a type of a probability density function" refers to the derivation of closed contours comprising points of equal intensities from the data within respective regions of the image as claimed. The Applicant wishes, at the outset, to point out that nowhere in Netsch could they find a statement or discussion about "Gaussian function is a type of probability density function" as quoted by the examiner. Therefore, the examiner has not made out a *prima facie* case of obviousness to the extent that the examiner's obviousness rejection relies upon this phantom teaching of Netsch. Moreover, the examiner's rejection cannot be sustained because the cited prior art and in particular Netsch does not disclose this claim 1 step. That is at least because the circle seen in Figure 3, equations (1)-(4), and the quoted expressions all refer to characteristics of the *filter* which is applied by Netsch to find the desired spots in the first place - similar to claim step (a). The cited Netsch portions do not in any way teach the derivation of contours from the data within regions of the *image* as claimed in applicant's subsequent step (c). Note for example that Figure 3 of Netsch is labelled as "Cross-section of the 2-D Laplacian filter with the *xz* plane for scale  $h=5$  and the corresponding view on the *xy* plane. The circle indicates the intersection of the lobe with the plane." Once again Madachy does not disclose this missing Netsch teaching. For this reason as well, independent claim 1 is non-obvious and patentable.

The Examiner acknowledges that Netsch does not disclose claim step (d) and turns to Madachy for this alleged disclosure. The Applicant has provided extensive reasons why Madachy does not disclose step (d) in their prior responses, some of which are reiterated below.

It is the examiner's position that the curvature  $R(i)$  at points around the contour as mentioned in the SHAPE section of Madachy discloses the claim 1 step (d) feature of producing a measure of concavity of at least one respective contour. However, the individual values of curvature around the contour as described in Madachy are not themselves a measure of concavity of the contour. While Madachy indicates that a set of curvatures is used to derive so-called "bending energy" there is no express disclosure of using curvature data to produce a measure of *concavity* of the contour.

Even though the measurement of curvature  $R(i)$  at points around the contour of Madachy *could* result in a measurement of concavity, if the curvature data was suitably processed to do so, Madachy does not disclose or suggest that this is or should be done. The measurement of curvature alone does not result in a measurement of concavity and the most important point is that Madachy does not teach that you should use that data to measure concavity. So Madachy does not expressly disclose a measure of concavity. For this reason too claim 1 cannot be obvious over Netsch et al in view of Madachy et al as asserted by the examiner.

A further reason why all claims are non-obvious and patentable is because the combination of Netsch and Madachy does not logically lead to the claimed invention. According to MPEP §§ 2142 and 2143, it is the Examiner's burden to establish a *prima facie* case of obviousness by clearly articulating reasons with rational factual underpinnings to support the conclusion of obviousness. The examiner has not met this burden here because the problems solved by the two references are so different that it would have been illogical for a person of ordinary skill in the art faced with the prior art to combine the references as the examiner has.

The dramatic differences between the references are seen quite clearly from the purposes of the two methods. The object of Netsch is to detect microcalcifications in digital mammograms, for which purpose it is necessary to find bright, almost circular spots in the mammogram (Netsch method step (1) on page 776 of the reference). The object of Madachy, on the other hand, is to identify mitotic cells in cervical biopsies (see title, Abstract and references to mitotic cells throughout the reference). Mitotic cells are cells which are undergoing division and Madachy seeks to distinguish such cells from those in interphase (see INTRODUCTION in the reference). For this reason Madachy computes various descriptors of the cell images as described under SHAPE and TEXTURE in the reference. None of these are anything like the bright, almost circular spots sought by Netsch, however, because mitotic cells have a very different appearance to microcalcifications and in particular are not "almost circular" but are characterised by jagged edges as indicated in the last sentence of Madachy's SHAPE section and as seen in Figure 2 of the reference. It would not, therefore, have been obvious or logical to one of ordinary skill in the art at the time of the invention to apply features of Madachy's method to Netsch's method to provide automated detection of microcalcifications as suggested by Netsch because Madachy is concerned with a different problem requiring the detection of different kinds of objects in the image to those with which Netsch is concerned.

Claims 2-18, 20, 22 and 25 all depend on claim 1, or recite the same limitations as claim 1, and hence are patentable for at least the same reasons as discussed above in relation to claim 1.

The examiner's rejections of claims 15-16 appear to be incomplete. In rejecting claim 1, the examiner noted that Netsch does not teach claim 1 step (d). Claims 15-16 depend upon claim 1. However, the examiner has not cited Madachy in rejecting claims 15-16. Therefore the examiner, at the very least, has not made out a *prima facie* case of obviousness of claims 15 or 16 because there is no showing of where step (d) of claims 15-16 is found in the prior art.

### CONCLUSION

All pending application claims are patentable for the reasons recited above. Favorable reconsideration and allowance of all pending claims, is therefore courteously solicited.

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